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## 9.3 California Red-legged Frog

### 9.3.1 Status of the Species

The Service listed the California red-legged frog (*Rana draytonii*) as threatened on May 23, 1996 (61 FR 25813) and designated critical habitat on May 17, 2010. The action area of the PA is not located within designated critical habitat for this species. A recovery plan for the species was finalized on September 12, 2002 (Service 2002) and a 5-year review of the species was initiated on March 25, 2011 (Service 2011). The following paragraphs provide a summary of the relevant information in the recovery plan and 5-year review.

#### *Recovery Plan*

The Recovery Plan for the California red-legged frog identifies eight recovery units (Service 2002). The establishment of these recovery units is based on the determination that various regional areas of the species' range are essential to its survival and recovery. These recovery units are delineated by major watershed boundaries as defined by U.S. Geological Survey hydrologic units and the limits of its range. The goal of the recovery plan is to protect the long-term viability of all extant populations within each recovery unit. Within each recovery unit, core areas have been delineated and represent contiguous areas of moderate to high California red-legged frog densities that are relatively free of exotic species such as bullfrogs. The goal of designating core areas is to protect metapopulations. When combined with suitable dispersal habitat, this will allow for the long-term viability within existing populations. This management

strategy identified within the Recovery Plan will allow for the recolonization of habitats within and adjacent to core areas that are naturally subjected to periodic localized extinctions, thus assuring the long-term survival and recovery of California red-legged frogs.

### *Habitat*

California red-legged frogs predominately inhabit permanent water sources such as streams, lakes, marshes, and natural and manmade ponds in valley bottoms and foothills up to 4,921 ft in elevation (Jennings and Hayes 1994, Bulger *et al.* 2003, Stebbins 2003). However, they also inhabit ephemeral creeks, drainages and ponds with minimal riparian and emergent vegetation. Habitat includes nearly any area within 1-2 miles of a breeding site that stays moist and cool through the summer including vegetated areas with coyote brush, California blackberry thickets, and root masses associated with willow and California bay trees (Fellers 2005). Sheltering habitat for California red-legged frogs potentially includes all aquatic, riparian, and upland areas within the range of the species and includes any landscape feature that provides cover, such as animal burrows, boulders or rocks, organic debris such as downed trees or logs, and industrial debris. Agricultural features such as drains, watering troughs, spring boxes, abandoned sheds, or hay stacks may also be used. Incised stream channels with portions narrower and depths greater than 18 inches also may provide important summer sheltering habitat. Accessibility to sheltering habitat is essential for the survival of California red-legged frogs within a watershed, and can be a factor limiting frog population numbers and survival.

### *Threats*

Habitat loss, non-native species introduction, and urban encroachment are the primary factors that have led to the current status of the California red-legged frog throughout its range. Several researchers in central California have noted the decline and eventual local disappearance of California and northern red-legged frogs in systems supporting bullfrogs (Jennings and Hayes 1990; Twedt 1993), red swamp crayfish, signal crayfish, and several species of warm water fish including sunfish, goldfish, common carp, and mosquitofish (Moyle 1976; Barry 1992; Hunt 1993; Fisher and Schaffer 1996). This has been attributed to predation, competition, and reproduction interference. Twedt (1993) documented bullfrog predation of juvenile northern red-legged frogs, and suggested that bullfrogs could prey on subadult California red-legged frogs as well. Bullfrogs may also have a competitive advantage over California red-legged frogs. For instance, bullfrogs are larger and possess more generalized food habits (Bury and Whelan 1984). In addition, bullfrogs have an extended breeding season (Storer 1933) during which an individual female can produce as many as 20,000 eggs (Emlen 1977). Furthermore, bullfrog larvae are unpalatable to predatory fish (Kruse and Francis 1977). Bullfrogs also interfere with California red-legged frog reproduction by eating adult male California red-legged frogs. Both California and northern red-legged frogs have been observed in amplexus (mounted on) with both male and female bullfrogs (Jennings and Hayes 1990; Twedt 1993; Jennings 1993). Thus bullfrogs are able to prey upon and outcompete California red-legged frogs, especially in sub-optimal habitat.

The urbanization of land within and adjacent to California red-legged frog habitat has also affected the threatened amphibian. These declines are attributed to channelization of riparian areas, enclosure of the channels by urban development that blocks dispersal, and the introduction of predatory fishes and bullfrogs.

Diseases may also pose a significant threat, although the specific effects of disease on the California red-legged frog are not known. Pathogens are suspected of causing global amphibian declines (Davidson *et al.* 2003). Chytridiomycosis and ranaviruses are a potential threat because these diseases have been found to adversely affect other amphibians, including the California red-legged frog (Davidson *et al.* 2003; Lips *et al.* 2006). Mao *et al.* (1999 cited in Fellers 2005) reported northern red-legged frogs infected with an iridovirus, which was also presented in sympatric threespine sticklebacks in northwestern California. Non-native species, such as bullfrogs and non-native tiger salamanders that live within the range of the California red-legged frog have been identified as potential carriers of these diseases (Garner *et al.* 2006). Humans can facilitate the spread of disease by encouraging the further introduction of non-native carriers and by acting as carriers themselves (*i.e.*, contaminated boots, waders or fishing equipment). Human activities can also introduce stress by other means, such as habitat fragmentation, that results in the listed species being more susceptible to the effects of disease.

### *Climate Change*

The global average temperature has risen by approximately 0.6 degrees Celsius during the 20th Century (IPCC 2001; IPCC 2007a; IPCC 2007b). There is an international scientific consensus that most of the warming observed has been caused by human activities (IPCC 2001, IPCC 2007a; IPCC 2007b), and that it is "very likely" that it is largely due to manmade emissions of carbon dioxide and other greenhouse gases (IPCC 2007b). Ongoing climate change (IPCC 2007b; Inkley *et al.* 2004; Kerr 2007) likely imperils California red-legged frog and its resources necessary for their survival. Since climate change threatens to disrupt annual weather patterns, it may result in a loss of their habitat and/or prey, and/or increased numbers of their predators, parasites, and diseases. Where populations are isolated, a changing climate may result in local extinction, with range shifts precluded by lack of California red-legged frog habitat.

### *Population*

California red-legged frogs are often prolific breeders that may live for 8 to 10 years (Jennings *et al.* 1992) and have egg masses containing 2,000 to 5,000 eggs per breeding season (Storer 1925, Jennings and Hayes 1994). Populations can fluctuate from year to year; favorable habitat conditions allow the species to have extremely high rates of reproduction and thus produce large numbers of dispersing young and a concomitant increase in the number of occupied sites. In contrast, the animal may temporarily disappear from an area when conditions are stressful (*e.g.*, during periods of drought, disease, etc.). The species has been extirpated from 70 percent of its former range but populations remain in approximately 256 streams or drainages in 28 counties in California.

### 9.3.2 Environmental Baseline

DWR modeled 3,616 acres of California red-legged frog habitat in the action area, including 118 acres of aquatic and 3,498 acres of modeled upland cover and dispersal habitat (CWF BA 2016). The action area is not located within the species designated critical habitat, but both the action area and smaller construction footprint are within Recovery Unit 4 of the Recovery Plan and may contain suitable habitat, as described in the *Status of the Species*, and indicated by GIS modeling. The construction footprint and associated effects are located with the range and near the Mount Diablo (CCS-2A) unit of designated critical habitat. There is potential for the species to be present (*i.e.*, inhabit, forage, breed, and disperse) within the action area during the duration of the project as demonstrated by: (1) historic and recent observation of the species within dispersal distance of the construction footprint, (2) presence of constructed drainage features, perennial and seasonal ponds (*e.g.*, levee seepage ponds), that may provide breeding and non-breeding aquatic habitat for the California red-legged frog, (3) presence of suitable upland habitat with rodent burrows and other cover sites within dispersal distance from aquatic habitat, and (4) numerous locations and movement corridors where the species can move within the action area and vicinity.

The Service has completed numerous section 7 consultations concerning California red-legged frog in the action area. Some past substantial consultations near the construction footprint include: (1) *Byron Highway Shoulder Widening Project* (Service File No. 81420-2011-F-072) and (2) *Delta-Mendota Canal/California Aqueduct Intertie Project* (Service File No. 81420-2009-F-1156). Both of these projects have documented presence of the species and permanent habitat loss.

In the action area, California red-legged frog has been detected in aquatic habitats within the grassland landscape west and southwest of CCF and in the vicinity of Brentwood and Marsh Creek along the west-central edge of the action area, and in some upland sites in the vicinity of Suisun Marsh (CWF BA 2016). Protocol level surveys, as described in Service's 2005 *Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog*, were not conducted or presented in the CWF BA.

An estimated 69.1 acres of California red-legged frog modeled habitat overlaps with the construction footprint and associated affected area, which includes 1 acre of modeled aquatic habitat and 68.1 acres of modeled upland cover and dispersal habitat.

### 9.3.3 Effects of the Proposed Action

Certain activities included in the PA will have no effect on this species, since those activities and their resulting effects do not overlap with modeled suitable habitat for the California red-legged frog. Those activities include: safe haven work areas, NDD, tunnel conveyance facilities, and the HORG. Activities included in the PA that will have adverse effects on California red-legged frog and its modeled suitable habitat are: the geotechnical exploration, the CCF modification, power

supply and grid connections, CCWD Settlement actions and placement of the reusable tunnel material.

The activities listed above are expected to affect the California red-legged frog through mortality, capture, injury, harassment, and harm of individual eggs, larvae, subadults and adults. Ground disturbance associated with construction activities will result in removal of vegetation and other materials utilized for cover and aestivation, fill or crush burrows or crevices, and reduce the prey base for the California red-legged frog. Since California red-legged frog utilizes small mammal burrows and soil crevices for shelter, individuals may be crushed, buried, or otherwise injured during construction activities. Disturbance caused by construction activities may cause individuals to disperse into areas containing unsuitable habitat, and increase the risk of predation or other sources of mortality. Direct injury or mortality to the animals may result from night-lighting, noise, and vibration, which are further described below.

#### *Increased Vibration*

Construction activities could generate vibrations that simulate rain, which could cause accidental emergence from burrows. The effects analysis in the CWF BA describes those vibrations as extending 75 ft outside the project footprint into upland habitat but this description is not supported by the referenced material presented in the CWF BA. The references include: (1) Dimmitt and Ruibal (1980), whom were able to induce emergence by setting an off-balance test tube spinner within 1 meter of the burrow, which vibrated the soil in close proximity to the animals, and observed almost 100% emergence, and (2) California Department of Transportation's (2013) technical monitoring that states that a bulldozer produces perceivable vibration to 135 ft. The CWF BA did not provide an analysis that quantifies how DWR concluded 75 ft. The CWF BA estimated that vibration will affect approximately 4 acres of modeled suitable upland habitat by extending the project footprint in modeled suitable habitat by 75 ft. DWR has proposed compensation at a ratio of 3:1 for the 4 acres as mitigation for all anticipated effects of noise, vibrations, and lighting (ICF Memo 9/23/2016). DWR has not proposed to monitor increased vibrations that could be caused by the proposed construction. Modeled suitable upland habitat will be affected for the duration of construction by increased vibrations.

#### *Increased Lighting*

DWR states construction activities could generate light, which could cause California red-legged frog to emerge from burrows or other cover at night and make them vulnerable to predation (CWF BA 2016). The effects of increased ambient lighting on amphibians are well documented. Long and Rich (2006) documented that increased illumination affects mate choice decisions, interindividual spacing, anti-predator behavior, or relative reliance on different modalities (*e.g.*, visual or auditory). Female frogs may also alter their oviposition site choice (Tarano 1998). Chronic illumination, similar to that proposed in the CWF BA, can affect the behavior of individuals, and can affect multiple individuals that are vocalizing simultaneously (Long and Rich 2006). DWR proposes to limit night construction to the greatest extent practicable, but did

not quantify the amount of suitable modeled habitat that potentially could be affected by the increase in lighting necessary to complete proposed nighttime construction. DWR has proposed to protect 4 acres of suitable habitat, based on the 75-ft distance from the edge of the construction footprint, as mitigation for all anticipated effects of noise, vibrations, and lighting (ICF Memo 9/23/2016). DWR has also proposed that *“if light spillover into adjacent California red-legged frog habitat occurs, a Service-approved biologist will be present during night work to survey for burrows and emerging California red-legged frogs in areas illuminated by construction lighting. If California red-legged frog is found above-ground the Service-approved biologist has the authority to terminate the project activities until the light is directed away from the burrows, the California red-legged frog moves out of the illuminated area, or the California red-legged frog is relocated out of the illuminated area by the Service-approved biologist”*. While Service-approved relocation or stopping construction will minimize lighting effects on individuals that are observed, modeled suitable habitat will be affected for the duration of construction.

### *Increased Noise*

The expected increase in noise levels that California red-legged frog could experience resulting from the construction was not addressed in the CWF BA 2016. DWR did not propose any conservation measures to minimize or avoid this effect. Increased noise levels have been shown to be detrimental to frogs (Kaiser and Hammers 2009; Goosem *et al.* 2007; Nelson 2015). DWR has proposed to protect 4 acres of suitable habitat, based on the 75-ft distance from the edge of the construction footprint, as mitigation for all anticipated effects of noise, vibrations, and lighting (ICF Memo 9/23/2016).

### *Temporary Habitat Loss*

DWR estimates the geotechnical investigations will temporarily affect 6 acres, and the power supply and connections will temporarily affect 12 acres. DWR proposes to restore habitat to pre-project conditions that is affected by the geotechnical investigations and the construction of the power supply and grid connections. Upon completion of the PA, restoration of affected suitable modeled habitat (*e.g.*, construction areas, storage and staging areas, and temporary roads) will be accomplished by recontouring to pre-project elevations and revegetating with native vegetation seed mixture, in order not to be considered a permanent loss of habitat. There is potential for long-term harassment, injury or mortality of individuals in habitat that overlaps with the power supply and grid connections, due to the expected minimal ongoing vegetation management around the poles and under the lines. Any future vegetation management would require reinitiation of this BiOp, since suitable modeled is proposed to be restored, thus effects on suitable modeled habitat are considered temporary.

To minimize effects of the geotechnical investigation, in addition to the proposed conservation measures, work will only occur during the dry season. To minimize the effects of the power supply and connections, in addition to the proposed conservation measures, no construction activities will occur during rain events or within 24-hours following a rain event or during

nighttime hours. An open-top trailer will be used to elevate materials for onsite storage above ground such as pipes, conduits and other materials that could provide shelter for California red-legged frogs.

### *Permanent Habitat Loss*

The proposed PA is expected to result in the permanent loss of 52.34 acres of modeled suitable habitat. DWR proposes to compensate for permanent habitat loss and long-term adverse construction effects at a 3:1 ratio by purchasing 157.02 acres habitat within the East San Francisco Bay core recovery area at locations subject to Service-approval. The compensation habitat will be preserved prior to the impact and managed in-perpetuity. Preservation of high value habitat in the East San Francisco Bay core recovery area will allow for the permanent protection, long-term management, and enhancement of the habitat for the California red-legged frog which will contribute to the recovery of this species. Compensation habitat features must include: (1) grasslands containing stock ponds and other aquatic features that provide aquatic breeding habitat, and (2) lands connecting with existing protected grassland.

Preconstruction surveys of the modeled suitable habitat impacted by the project footprint and the relocation of the California red-legged frog may reduce injury or mortality. However, death and injury of individual California red-legged frogs could occur at the time of relocation or later in time subsequent to their release. Although survivorship for translocated members of this species has not been determined, survivorship of translocated wildlife, in general, is lower because of intraspecific competition, lack of familiarity with the location of potential breeding, feeding, and sheltering habitats, increased risk of contracting disease in a foreign environment, and the risk of predation. Improper handling, containment, or transport of individuals will be reduced or prevented by use of a Service-approved biologist, limiting the duration of handling and distance of translocation, and requiring the proper transport and release of the animals. Even with a Service-approved biologist present at the project site, worker awareness, and escape ramps, animals may fall into the trenches, pits, or other excavations, and then risk being directly injured, killed, or be unable to escape and die as a result of desiccation, entombment, or starvation.

### **9.3.4 Effects to Recovery**

The PA would not increase the threats currently impacting the California red-legged frog recovery units or core areas as identified in the recovery plan, as described in the *Status of the Species*, or preclude implementation of recovery actions. The resulting adverse effects of the PA to the species habitat are considered permanent due to the PA's footprint and duration. Suitable habitat affected is outside of any core recovery area; therefore, with implementation of the proposed conservation measures, the PA is expected to result in minimal change in population numbers and distribution.



### **9.3.5 Reinitiation Triggers**

Some project elements and their effects on California red-legged frog will likely change as the PA is refined. Therefore, reinitiation is required if additional habitat is affected or more individuals will be exposed based on these changes, such as proposed locations of vibration, nighttime illumination, noise caused by construction extends past 75 ft of the construction footprint, or any long-term vegetation management associated with the power and supply grid.

### **9.3.6 Cumulative Effects**

The activities described in Section 9.2.5 for delta smelt are also likely to affect California red-legged frog. These include agricultural practices, recreation, urbanization and industrialism, and greenhouse gas emissions. Therefore, the effects described in Section 9.2.5. are incorporated by reference into this analysis for the California red-legged frog.

### **9.3.7 Conclusion**

In determining whether a proposed action is likely to jeopardize the continued existence of a species, we consider the effects of the action with respect to the reproduction, numbers, and distribution of the species. We also consider the effects of the action on the recovery of the species. In that context, the following paragraphs summarize the effects of the PA on the California red-legged frog.

#### *Reproduction*

The breeding habitat in the action area represents a small proportion of the total breeding habitat within the 28 counties in California where this species is believed to occur. Therefore, the PA will not appreciably affect California red-legged frog reproduction range-wide, and we conclude that the effects would not reduce the range-wide reproductive capacity of the species.

#### *Numbers*

The aquatic and upland habitat within the action area represents a small proportion of the total amount of habitat range-wide. Also, Reclamation has proposed measures to avoid and minimize the effects of the PA on the species. Despite the proposed conservation measures, we anticipate the PA is likely to adversely affect California red-legged frog; however, the number of individuals affected will be very low relative to the range-wide numbers. Therefore, the PA will not appreciably reduce the number of California red-legged frogs.

#### *Distribution*

The habitat within the action area is near the center of their range. We do not anticipate that the range-wide distribution of the California red-legged frog will be reduced because it will not eliminate the species from any recovery core area or county. The effect to the species from

habitat loss and fragmentation will be minimized by the proposed compensatory mitigation measures. Therefore, we do not expect Reclamation's actions will reduce the species' distribution relative to its range-wide condition.

### *Effects on Recovery*

Reclamation and DWR are proposing to minimize the adverse effects of the loss of suitable habitat by implementing actions to promote the recovery of the affected species in a manner where the mitigation is commensurate with the adverse effect. Reclamation and DWR have proposed to restore or protect suitable habitat to offset the total loss of suitable habitat. Habitat loss and degradation are contributing factors to the decline of California red-legged frog; restoration or protection of additional suitable habitat is a reasonable means of offsetting the adverse effects and may benefit the recovery of this species. Consequently, we conclude that the PA would not appreciably reduce the likelihood of recovery of the California red-legged frog.

### *Conclusion*

After reviewing the current status of the California red-legged frog, the environmental baseline for the action area, the effects of the PA, and the cumulative effects, it is the Service's biological opinion that the PA is not likely to jeopardize the continued existence of the California red-legged frog. We have reached this conclusion because:

1. The number of California red-legged frogs likely to be affected by project activities will be low.
2. The low number of individuals likely to be affected by the project will not appreciably reduce the likelihood of survival and recovery of the species range-wide because many more individuals and larger habitat areas outside of the action area will remain.
3. Reclamation and DWR have proposed numerous and comprehensive measures to avoid and minimize potential effects, including compensatory mitigation measures.
4. Reclamation and DWR propose to restore or protect habitat that could support the species.
5. The project is being implemented in a manner that will minimize or avoid effects to California red-legged frogs.

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#### 9.4 California Tiger Salamander

##### 9.4.1 Status of the Species

The Service listed the Central California Distinct Population Segment (DPS) of the California tiger salamander (*Ambystoma californiense*) as threatened on August 8, 2004 (69 FR 48570-48649). Critical habitat was designated in 2005; however, there is no designated critical habitat in the action area for the PA and will not be discussed further. We completed a draft recovery plan for the species on March 10, 2016 (Service 2015) and published a 5-year review on October

21, 2014 (Service 2014). The following paragraphs provide a summary of the relevant information in the draft recovery plan and 5-year review.

### *Recovery Plan and Five Year Review*

The draft recovery plan for the California tiger salamander Central California DPS has been classified in four recovery units. The recovery units represent both the potential extent of Central California tiger salamander habitat within the species' range and the biologically (genetically) distinct areas where recovery actions should take place that will eliminate or ameliorate threats. The recovery units also contain management units. These management units were created to manage recovery units at a finer scale, as well as to ensure that the full genetic, geographic and ecological range of each distinct recovery unit is represented. The strategy to recover the Central California tiger salamander focuses on alleviating the threat of habitat loss and fragmentation in order to increase population resiliency (ensure each population is sufficiently large to withstand stochastic events), redundancy (ensure a sufficient number of populations to provide a margin of safety for the species to withstand catastrophic events), and representation (conserve the breadth of the genetic makeup of the species to conserve its adaptive capabilities). By ensuring preservation and management actions within each management unit, the recovery plan ensures the conservation of self-sustaining populations of Central California tiger salamanders throughout the full ecological, geographical, and genetic range of the species. The latest five year review by the Service, determined that the Central California tiger salamander listing status for the species should remain as threatened.

### *Habitat*

The Central California tiger salamander is restricted to disjunct populations that form a ring along the foothills of the Central Valley and Inner Coast Range from San Luis Obispo, Kern, and Tulare counties in the south, to Sacramento and Yolo counties in the north.

The Central California tiger salamander primarily inhabits annual grasslands and open woodlands (Stebbins 1985; Shaffer *et al.* 2013). The Central California tiger salamander requires upland habitat that is occupied by small burrowing mammals such as California ground squirrel (*Otospermophilus beecheyi*) and Botta's pocket gopher (*Thomomys bottae*) that create underground burrow systems utilized by the salamanders throughout the year (Shaffer *et al.* 1993; Seymour and Westphal 1994; Loredó *et al.* 1996; Pittman 2005). Upland habitats surrounding known Central California tiger salamander breeding pools are usually dominated by grassland, oak savanna, or oak woodland (CNDDDB 2015). Large tracts of upland habitat, preferably with multiple breeding ponds, are necessary for the Central California tiger salamander to persist. Although Central California tiger salamanders are adapted to breeding in natural vernal pools and ponds, they now frequently use livestock ponds and other modified ephemeral and permanent ponds. Breeding ponds, whether natural or man-made, must have a long enough ponding duration for adult Central California tiger salamanders to breed and also pond water long enough for larvae to mature into juveniles capable of dispersing from the aquatic breeding site to suitable terrestrial habitat. Optimum breeding habitat is ephemeral and

dries down before August or September, which prevents bullfrogs (*Rana catesbeiana*) or non-native fish species from establishing breeding populations (Service 2005). California tiger salamanders can be found in permanent ponds; permanent ponds used by California tiger salamanders are usually free of predatory fish or breeding bullfrog populations (Shaffer *et al.* 1993; Fisher and Shaffer 1996). This species is not known to breed in streams or rivers; however breeding populations have been reported in ditches that contain seasonal wetlands (D. Cook 2009; Seymour and Westphal 1994) and in slow-moving swales and creeks situated near other suitable breeding habitat (Alvarez *et al.* 2013).

### *Threats*

The loss, degradation, and fragmentation of habitat as the result of human activities are the primary threats to the Central California tiger salamander (Service 2004, 2014). Aquatic and upland habitat available to Central California tiger salamanders has been degraded and reduced in area through agricultural conversion, urbanization, road construction, and other projects (Service 2014). Central California tiger salamander populations occur in scattered and increasingly isolated breeding sites, reducing opportunities for inter-pond dispersal.

Central California tiger salamander is also threatened by predation from non-native fish (*e.g.*, largemouth bass [*Micropterus salmoides*] and blue gill [*Lepomis macrochirus*]) species or invasive species (*e.g.*, bullfrog). Other threats to the species include road mortality, hybridization with non-native tiger salamanders, contaminants, mosquito control efforts, and livestock grazing.

### *Climate Change*

Central California tiger salamanders may be affected by climate change; however, the Service lacks sufficient certainty about how and how when climate change will affect the species. The distribution of the Central California tiger salamander spans a considerable range in climatic conditions, and it is not clear how the various sub-populations of the Central California tiger salamander might differ in their responses to climate change.

California experiences highly variable annual rainfall events and droughts. California tiger salamanders have adapted to a life history strategy to deal with these inconsistent environmental conditions. For example, given the sensitivity of California tiger salamander breeding success to rainfall amounts and timing, different breeding habitats may serve as sources in different years, buffering the metapopulation against climatic variability (Cook *et al.* 2005). However, despite these life history strategies, climate change could result in even more erratic weather patterns that California tiger salamanders cannot adapt to quickly enough. If a drought occurs, ponds may not persist long enough for larvae to transform and temperature extremes or fluctuations in water levels during the breeding season may kill large numbers of embryos. Presumably, the longevity of adult Central California tiger salamanders is sufficient to ensure local population survival through all but the longest droughts (Barry and Shaffer 1994). However, if long-term droughts become the norm in the future, this will have significant implications for Central California tiger salamanders, because the ponds they depend on for breeding may not hold water long enough to

support breeding populations. In addition, drought conditions favor non-native hybrid tiger salamanders in areas where hybrids occur (Johnson *et al.* 2010b).

### *Population*

The Central California tiger salamander has a metapopulation structure of local populations or breeding sites within an area, where dispersal from one local population or breeding site to other areas containing suitable habitat is possible, but is not routine.

The available data suggest that most populations consist of relatively small numbers of breeding adults; breeding populations in the range of a few pairs up to a few dozen pairs are common, and numbers above 100 breeding individuals are rare (CDFG 2010). However, this species exhibits high variation in population numbers and may not breed in an individual pool every year (Loredo and Van Vuren 1996; Trenham *et al.* 2000). The environmental factors that play a role in this fluctuation are not entirely understood, but likely are related to climatic conditions, including the timing of rainfall events, amount of rainfall, or unseasonably high temperatures. Other factors may include predator/prey assemblages, with environmental conditions favoring species that predate on or compete with Central California tiger salamander larvae (Bobzien and DiDonato 2007).

Population numbers of Central California tiger salamanders fluctuate and they may not breed in an individual pool every year. Surveys conducted in a proposed project area that include multiple potential breeding pools may only detect Central California tiger salamander larvae in some of the pools, or even in none of the pools (*e.g.*, in years with low rainfall when the species does not successfully breed). There is a high likelihood that pools that contained no Central California tiger salamander larvae at the time of the surveys could provide suitable breeding habitat in future years when conditions are more favorable.

#### **9.4.2 Environmental Baseline**

There are 12,724 acres of modeled suitable Central California tiger salamander habitat in the action area (CWF BA 2016). Both the action area and smaller construction footprint contain habitat for the species, as described in the *Status of the Species* and indicated by GIS modeling.

There is potential for Central California tiger salamanders to be present (*i.e.*, inhabit, forage, breed, aestivate and disperse) within the action area and construction footprint during the duration of the PA as demonstrated by: (1) the area is within the historical and current range of the species, (2) suitable upland and dispersal habitat for juvenile and adult life history stages of the species with rodent burrows and other cover sites, (3) connectivity with known occupied habitat for species, and (4) the presence of numerous seasonal and perennial ponds within the action area, including livestock ponds.

The Service has completed numerous section 7 consultations concerning Central California tiger salamander in the action area. Two of the more substantial consultations near the construction



footprint include: (1) Byron Highway Shoulder Widening Project (Service File No. 81420-2011-F-072), and the (2) Delta-Mendota Canal/California Aqueduct Intertie Project (Service File No. 81420-2009-F-1156). Both of these projects have documented presence of the species and permanent habitat loss.

In the action area, there are several occurrences of occupied Central California tiger salamander habitat located immediately southwest of Clifton Court Forebay. There are numerous additional occurrences of California tiger salamander in vernal pool and pond habitats in the nearby grassland foothills. Vernal pool habitats in Yolo and Solano Counties west of Liberty Island and in the vicinity of Stone Lakes in Sacramento County also provide suitable habitat for the species. Protocol level surveys, as described in Service's 2005 *Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander*, were not conducted or presented in the CWF BA.

An estimated 58 acres of Central California tiger salamander modeled habitat overlaps with the construction footprint and associated effects.

#### **9.4.3 Effects of the Proposed Action**

Certain activities included in the PA will have no effect on this species, since those activities do not overlap with modeled suitable habitat for the Central California tiger salamander. Those activities are the safe haven work areas, north Delta intakes, tunnel conveyance facilities, HORG and placement of the reusable tunnel material. Activities included in the PA that will have adverse effects on Central California tiger salamander and its modeled suitable habitat are the geotechnical explorations, the CCF modification, and power supply and grid connections.

The activities listed above are expected to affect the threatened Central California tiger salamander through capture, harassment, harm, injury and mortality of all life stages. The PA is expected to result in permanent habitat loss. Ground disturbance and construction activities associated with the PA will result in loss of upland habitat used for dispersal, refugia, and foraging. Central California tiger salamanders that are using small mammal burrows or cracks in the soil within the construction footprint of the PA are likely to be killed during grading and ground compaction activities as burrows are crushed and the inhabitants of burrows are entombed. Central California tiger salamanders may be killed or injured from inadvertent trampling by workers from foot traffic and operation of construction equipment during construction activities. Central California tiger salamanders may also become trapped in open excavations or construction trenches, making them vulnerable to desiccation, starvation, and predation. Injury or mortality to the Central California tiger salamanders may result from harassment from night lighting, noise and vibrations due to increased exposure to desiccation and predation, further described below.

### *Increased Vibrations*

Construction activities could generate vibrations that simulate rain, which could cause accidental emergence from burrows. The effects analysis in the CWF BA describes those vibrations as extending 75 ft outside the project footprint into upland habitat but this description is not supported by the referenced material presented in the CWF BA. The references include: (1) Dimmitt and Ruibal 1980, whom were able to induce emergence by setting an off-balance test tube spinner within 1 meter of the burrow, which vibrated the soil in close proximity to the animals, and observed almost 100% emergence, and (2) the California Department of Transportation's (2013) technical monitoring that states that a bulldozer produces perceivable vibration to 135 ft. The CWF BA did not provide an analysis that quantifies how DWR concluded 75 ft. The CWF BA included an estimate that vibration will affect approximately 3 acres of modeled suitable upland habitat because the project footprint extends into modeled suitable habitat by 75 ft. DWR has proposed compensation at a ratio of 3:1 for the 3 acres they identified. DWR has proposed the 3 acres, based on the 75-ft distance from the edge of construction footprint, as mitigation for all anticipated effects of noise, vibrations, and lighting (ICF Memo 9/23/2016). DWR has not proposed to monitor increased vibrations that could be caused by the proposed construction. Modeled suitable upland habitat will be affected for the duration of construction by increased vibrations.

### *Increased Noise*

As stated above, construction associated with CCF modifications are expected to cause increased noise in Central California tiger salamander modeled suitable habitat. DWR did not analyze the expected increase in noise that Central California tiger salamander modeled suitable habitat could experience resulting from the construction of the PA, in the CWF BA. Increased noise levels may also result from construction of the power supply and grid connections, since typical construction heavy equipment is assumed to be used and the utilization of two helicopters to string the connections, which will land and take-off anywhere in the construction footprint. Salamanders sensitive to seismic substrate vibrations and may detect airborne sound despite their atympanic middle ears (Ross and Smith 1978; Christensen *et al.* 2015). Therefore, construction noise, and increased human activity may interfere with normal behaviors such as feeding, sheltering, movement between refugia and foraging grounds, and other essential behaviors of the Central California tiger salamander. DWR has proposed the 9 acres, based on the 3:1 ratio of the 3 acres within 75 feet of the edge of construction footprint, as mitigation for all anticipated effects of noise, vibrations, and lighting (ICF Memo 9/23/2016).

### *Increased Lighting*

Construction activities could generate light, noise and vibrations, which could cause the Central California tiger salamander to emerge from burrows or other cover at night and make them vulnerable to predation (CWF BA 2016). The adverse effects of increased ambient lighting on salamanders are well documented (Rich and Travis 2013). Lighting can affect foraging and movement of salamanders (Placyke and Grave 2001). Construction of the canal work area,

associated with CCF modifications is the only activity identified in the CWF BA to increase ambient illumination in Central California tiger salamander model suitable habitat. DWR plans on limiting night construction to the greatest extent practicable, but did not quantify the amount of suitable modeled habitat that potentially could be affected by the increase in lighting necessary to complete proposed nighttime construction. DWR has proposed the 9 acres, based on the 75-ft distance from the edge of construction footprint, as mitigation for all anticipated effects of noise, vibrations, and lighting (ICF Memo 9/23/2016). The duration of construction and increased lighting is expected to be 6 years. While Service-approved relocation or construction stoppage will minimize lighting effects on individuals that are observed, modeled suitable habitat will be affected for the duration of construction.

### *Temporary Habitat Loss*

DWR estimates the geotechnical explorations will temporarily affect 2 acres and the construction of the power supply and connections will temporarily affect 7 acres. DWR proposes to restore habitat to pre-project conditions that is affected by the geotechnical explorations and the construction of the power supply and grid connections. Upon completion of the PA, restoration of affected modeled suitable habitat (e.g., construction areas, storage and staging areas, and temporary roads) will be accomplished by recontouring to pre-project elevations and revegetating with native vegetation seed mixture within one year, in order not to be considered a permanent loss of habitat. Any future vegetation management would require reinitiation of this BiOp, since suitable habitat is proposed to be restored, and thus effects on suitable habitat are considered temporary.

To minimize effects of the geotechnical explorations and the construction of the power supply and grid connections, in addition to the proposed conservation measures, work will only occur during the dry season. To minimize the effects of the power supply and connections, in addition to the proposed conservation measures, no construction activities will occur during rain events or within 24-hours following a rain event or during nighttime hours and an open-top trailer to elevate materials for onsite storage above ground such as pipes, conduits and other materials that could provide shelter for Central California tiger salamanders.

### *Permanent Habitat Loss*

The proposed PA is expected to result in 50 acres of permanent habitat loss (47 acres within the project footprint for the CCF modification and power supply and grid connections and 3 acres that may be affected by activities generating vibrations). DWR proposes to compensate for permanent habitat loss and long-term adverse construction effects by purchasing habitat within the Byron Hills area at a ratio of 3:1, subject to Service-approval. The purchased compensation habitat will be preserved and managed in-perpetuity. Therefore, 150 acres of suitable habitat will be protected. Only terrestrial cover and aestivation habitat loss is proposed to occur; the PA is not expected to result in a loss of any aquatic breeding habitat. To offset the effects of permanent habitat loss, compensation habitat must be adjacent to or near occupied upland habitat. Grasslands targeted for protection will be located near important areas for conservation that were

identified in the East Contra Costa County Habitat Conservation Plan/ Natural Community Conservation Plan (HCP/NCCP) and will include appropriate upland and aquatic features, e.g., rodent burrows, stock ponds, intermittent drainages, and other aquatic features, etc.

Preservation of high value habitat identified in the HCP/NCCP within Byron Hills will allow for permanent protection, long-term management and enhancement of habitat for the Central California tiger salamander which will contribute to the recovery of the species. Compensation habitat features must include: (1) large contiguous landscapes that consist of grasslands, vernal pool complex, and alkali seasonal wetland complex and encompass the range of vegetation, hydrologic, and soil conditions that characterize these communities, (2) lands must maintain connectivity with protected grassland, vernal pool complex, and alkali seasonal wetland complex landscapes near proposed construction sites, including connectivity with lands that have been protected or may be protected in the future under the HCP/NCCP, and (3) grasslands containing stock ponds and other aquatic features that provide aquatic breeding habitat for Central California tiger salamander.

Preconstruction surveys of the modeled suitable habitat that is impacted by the project footprint and the relocation of the Central California tiger salamander may reduce injury or mortality. However, death and injury of individual Central California tiger salamanders could occur at the time of relocation or later in time subsequent to their release. Although survivorship for relocated members of this species has not been determined, survivorship of relocated wildlife, in general, is lower because of intraspecific competition, lack of familiarity with the location of potential breeding, feeding, and sheltering habitats, increased risk of contracting disease in a foreign environment, and the risk of predation. Improper handling, containment, lack of disease prevention measures, or improper transport of individuals will be reduced or prevented by use of a Service-approved biologist with experience with this species, limiting the duration of handling and the distance of relocation, and requiring the proper handling, transport, and release of the Central California tiger salamander. Even with a Service-approved biologist present at the project site, worker awareness, and escape ramps, animals may fall into the trenches, pits, or other excavations, and then risk being directly injured, killed, or be unable to escape and die as a result of desiccation, entombment, or starvation.

#### **9.4.4 Effects to Recovery**

The PA would not increase the threats currently impacting the Central California tiger salamander in the recovery units or management units identified in the draft recovery plan and described in the status of species, or preclude implementation of recovery actions. The PA is expected to result in permanent loss of 50 acres of Central California tiger salamander habitat. DWR has proposed to offset the adverse effects of the loss of individuals and habitat through conservation of 150 acres of habitat. As stated previously, habitat loss and degradation are contributing factors to the decline of Central California tiger salamander, by protecting and managing an additional 150 acres of habitat in-perpetuity will offset the loss of individuals as a result of the PA and may benefit the recovery of the Central California tiger salamander.

#### **9.4.5 Reinitiation Triggers**

Some project elements and their effects on Central California tiger salamander will likely change as the PA is refined. Therefore, reinitiation is required if additional habitat is affected or more individuals will be exposed based on these changes, such as proposed locations of vibration, nighttime illumination, noise caused by construction extends past 75 ft of the construction footprint, or any long-term vegetation management associated with the power and supply grid.

#### **9.4.6 Cumulative Effects**

The activities described in Section 9.2.5 for delta smelt are also likely to affect Central California tiger salamander. These include agricultural practices, recreation, urbanization and industrialism, and greenhouse gas emissions. Therefore, the effects described in Section 9.2.5. are incorporated by reference into this analysis for the Central California tiger salamander.

#### **9.4.7 Conclusion**

In determining whether a proposed action is likely to jeopardize the continued existence of a species, we consider the effects of the action with respect to the reproduction, numbers, and distribution of the species. We also consider the effects of the action on the recovery of the species. In that context, the following paragraphs summarize the effects of the PA on the California tiger salamander.

##### *Reproduction*

The breeding habitat in the action area represents a small proportion of the total breeding habitat in California where this species is believed to occur and the PA will not result in loss of breeding habitat. Therefore, the PA will not appreciably affect California tiger salamander reproduction range-wide, and we conclude that the effects would not reduce the range-wide reproductive capacity of the species.

##### *Numbers*

The aquatic and upland habitat within the action area represents a small proportion of the total amount of habitat range-wide. Also, Reclamation and DWR have proposed measures to avoid and minimize the effects of the PA on the species. Despite the proposed conservation measures, we anticipate the PA is likely to adversely affect California tiger salamander; however, the number of individuals affected will be very low relative to the range-wide numbers. Therefore, the PA will not appreciably reduce the number of California tiger salamanders.

##### *Distribution*

The habitat within the action area is near the northern extent of their range. We do not anticipate that the range-wide distribution of the California tiger salamander will be reduced because it will

not eliminate or significantly reduce the distribution of the species from any draft recovery unit or county. The effect to the species from habitat loss and fragmentation will be minimized by the proposed compensatory mitigation measures. Therefore, we do not expect Reclamation's actions will reduce the species' distribution relative to its range-wide condition.

### *Effects on Recovery*

Reclamation and DWR are proposing to minimize the adverse effects of the loss of suitable habitat by implementing actions to promote the recovery of the affected species in a manner where the mitigation is commensurate with the adverse effect. Reclamation and DWR have proposed to restore or protect suitable habitat to offset the total loss of suitable habitat. Habitat loss and degradation are contributing factors to the decline of California tiger salamander; consequently, restoration or protection of additional suitable habitat is a reasonable means of offsetting the adverse effects and may benefit the recovery of this species. Consequently, we conclude that the PA would not appreciably reduce the likelihood of recovery of the California tiger salamander.

### *Conclusion*

After reviewing the current status of the California tiger salamander, the environmental baseline for the action area, the effects of the PA, and the cumulative effects, it is the Service's biological opinion that the PA is not likely to jeopardize the continued existence of the California tiger salamander. We have reached this conclusion because:

1. The number of California tiger salamanders likely to be affected by project activities will be low.
2. The low number of individuals likely to be affected by the project will not appreciably reduce the likelihood of survival and recovery of the species range-wide because many more individuals and larger habitat areas outside of the action area will remain.
3. Reclamation and DWR have proposed numerous and comprehensive measures to avoid and minimize potential effects, including compensatory mitigation measures.
4. Reclamation and DWR propose to restore or protect habitat that could support the species.
5. The project is being implemented in a manner that will minimize or avoid effects to California tiger salamander.

#### **9.4.8 California Tiger Salamander Literature Cited**

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## 9.5 Giant Garter Snake

### 9.5.1 Status of the Species

The Service published a proposal to list the giant garter snake as an endangered species on December 27, 1991 (56 FR 67046). Critical habitat has not been designated for this species. The Service reevaluated the status of the snake before adopting the final rule, and it was listed as a threatened species on October 20, 1993 (58 FR 54053). A Draft Recovery Plan was proposed for the snake on July 2, 1999 (Service 1999) and currently in publication as the *Revised Draft Recovery Plan for the Giant Garter Snake* (Revised Draft Recovery Plan) (Service 2015). A 5-year review was conducted in 2006 where no change of status was recommended (Service 2006). An additional 5-year review was conducted in 2012 where no change of status was recommended (Service 2012). Please refer to the Revised Draft Recovery Plan for the species' description, habitat preference, and life history.

#### *Habitat Loss*

Historical records suggest that the giant garter snake inhabited freshwater marshes, streams, and wetlands along with their adjacent associated upland habitats throughout the length of the Sacramento and San Joaquin valleys in Central California. Today only about 5 percent of its historical wetland/upland habitat acreage remains. Nine populations are recognized in the Revised Draft Recovery Plan following an update of the thirteen populations described in the original listing. This change is based on recent surveys, which indicate that two populations were extirpated, and on genetic research, which lead to the grouping together of some of the previously described populations.

The loss and subsequent fragmentation of habitat is the primary threat to the giant garter snake throughout the Central Valley of California. Habitat loss has occurred from urban expansion, agricultural conversion, and flood control. Habitat fragmentation has ultimately resulted in the snake being extirpated from the southern one-third of its range in the San Joaquin Valley.

#### *Other Threats*

In addition to large landscape level habitat conversion, the Sacramento/ San Joaquin Delta populations of the giant garter snake are subject to a number of other existing and potential threats which include roads and vehicular traffic, climate change, and predation by non-native species. The recovery strategy is primarily focused on protecting existing, occupied habitat and identifying and protecting areas for habitat restoration, enhancement, or creation including areas that are needed to provide connectivity between populations. This strategy ultimately supports the recovery goal of establishing and protecting self-sustaining populations of the giant garter snake throughout the full ecological, geographical, and genetic range of the species.

Climate change has been linked to increases in the frequency and intensity of weather events, such as heat waves, droughts, and storms (Lenihan *et al.* 2003; California Climate Action Team 2006; IPCC 2007). Extreme events, in turn may cause mass mortality of individuals (by affecting habitat or ecosystem characteristics, for example) and significantly contribute to determining

which species will remain or occur in natural habitats (Whitfield *et al.* 2007). As California's average temperature and precipitation change, species ranges tied to climate dependent habitats are moving northward and upward, but in the future, range contractions are more likely than simple northward or upslope shifts (Loarie *et al.* 2008, 2009). Research has already revealed correlations between climate warming and declines in amphibians and reptiles in different parts of the world (Whitfield *et al.* 2007; McMenamin *et al.* 2008; Mitchell *et al.* 2008; Huey *et al.* 2010).

The giant garter snake is considered a semi-aquatic species and due to its habitat preferences, giant garter snake is subject to the detrimental effects of floods and drought. This is likely to be exacerbated with the increase in frequency and intensity of flood and drought events due to climate change. Giant garter snakes may be displaced during a flood, buried by debris, exposed to predators, and subject to drowning when burrows and over-wintering sites become inundated with water. Giant garter snakes are not known to occupy the area within the Sutter Bypass which is flooded regularly (Wylie *et al.* 2005); although snakes are known to occupy the Yolo Bypass during the active season when flooding is unlikely (E. Hansen 2009). Snakes appear to survive at least some inundation of their burrows. Wylie observed snakes emerging from burrows after a period of inundation (G. Wylie, U.S. Geological Survey, personal communication).

Because of the giant garter snake's dependence upon permanent wetlands, water availability will play a significant role in its survival and recovery. In a state where much of the wetland habitat is maintained by managed water regimes, the lack of sufficient water supply may preclude consistent and timely delivery of water to sustain suitable habitat for giant garter snake. Drought conditions place additional strains on the water allocation system. Where populations currently persist on only marginal habitat, emergent drought or higher temperature conditions are likely to result in high rates of mortality in the short term with the effects of low fecundity and survivorship persisting after the drought has ceased (McMenamin *et al.* 2008; Mitchell *et al.* 2008). It is unknown how quickly giant garter snake populations may rebound after severe climatic conditions, particularly since these conditions might further exacerbate the impact from existing threats to giant garter snake, such as habitat loss and fragmentation, and small, isolated populations. Giant garter snake as a species has survived recorded historic droughts, but presumably under conditions where fewer cumulative threats existed.

### **9.5.2 Environmental Baseline**

Nearly all of the research on movement for the giant garter snake has been conducted on individuals in the Sacramento Valley; however, the geography in the Sacramento/San Joaquin Delta is comparably different to the Sacramento Valley due to the island structure of the Delta. These islands are surrounded by numerous large waterbodies, large tributaries and experiences a significant tidal influence from the San Pablo and San Francisco Bays. Giant garter snakes have been found on the various islands in the Delta and utilization and/or the frequency to which they use the large rivers and open tributaries surrounding these islands for dispersal is currently unknown. Giant garter snakes are apparently capable of long-distance movements, although less movement is observed when water is maintained on-site through the summer that supports their habitat (Wylie *et al.* 2002). Movement statistics of giant garter snakes vary greatly and it is likely

that giant garter snake movement is different due to the geographical difference of the Delta to the Sacramento Valley. Based on the research conducted in the Sacramento Valley, Hansen (1986) reported that individuals move less than 100 ft (30.5 m) during the spring in favored habitat. At the Colusa Drain, distances between captures of individuals ranged from 0.7 to 3.3 km (Wylie 2003). Using radio telemetry at the same location in 2006, individual mean movement distance was 63 m/day (range of 3–173 m/day), with a corresponding individual movement rate of 104 m/day (range of 12–287 m) during the “active season” (Wylie and Amarello 2006). Mean maximum individual movement distance was 862 m (range of 34–2,791 m), and total movement over the time radio-tracked averaged 4,761 m (range of 107–16,995 m; Wylie and Amarello 2006). Active-season minimum total distance moved at the same site in 2004 ranged from 0.7 to 215 km (Wylie and Martin 2004c).

Population status of giant garter snakes in the Delta is relatively undetermined and likely underestimated because sightings are sporadic in time and distance. As an example, an individual giant garter snake was sighted on Sherman Island near the Antioch Bridge in 1987 with a single reoccurring sighting in 2012 (CNDDDB 2012) and a newer sighting in April of 2016 (Service 2016). A documented sighting of a dead individual was recorded around Empire Cut in the south Delta (CNDDDB 2010), a live individual was found at Webb Tract in the central Delta (CNDDDB 2014), and the most recent occurrences of several live and one dead individual were found in the riprap shoreline on Jersey Island with another possible individual sighted across the waterway by the landowner on Bradford Island during the installation of the 2015 rock drought barrier on False River (DWR 2015). Up to six confirmed sightings of individuals on Sherman Island, Twitchell Island, and Bradford Island have been documented since March of 2016 (Service 2016). Most recently, seven giant garter snakes were observed basking in the riprap shoreline of Jersey Island during a pre-construction survey on May 31, 2017. Seven giant garter snakes were again documented the following day on June 1, 2017. Ten snake skin sheds, presumed to be giant garter snake from the visible faint stripe patterning, were also documented in the same vicinity (Stillwater Sciences 2017).

The recent sightings within the last seven years were mostly by chance and not part of focused surveys which in contrast have had difficulty detecting giant garter snakes in the Delta. Swaim Biological Consulting conducted a series of surveys for giant garter snakes from 2004 to 2005 near the City of Oakley in Contra Costa County, which comprises a large portion of the Hotchkiss Tract immediately south of Bethel Island. No giant garter snakes were found although the trapping effort included both aquatic and terrestrial trap-lines, and was conducted during the active season for the snake (Swaim 2004, 2005a, 2005b, 2005c, 2005d, 2006). DWR also conducted a trapping survey of various sites within the Delta including Sherman Island and Holland Tract that met habitat assessment criteria for giant garter snake during the summer of 2009 (DWR 2010). No giant garter snakes were trapped or observed during those surveys either. Currently, the only known source population for giant garter snake in the Delta region is located in the Eastern Delta at Caldoni Marsh near the City of Stockton. However, it is unlikely that the recent occurrences of snakes found in the Central and Western Delta originated from Caldoni Marsh considering the distances of those occurrences from Caldoni Marsh, the distances between occurrences, and the estimated dispersal range from telemetry studies. The recent number of documented occurrences within close proximity of each other in the western portion of the Delta

suggests there is likely a reproducing population of giant garter snake in this region. It should also be noted that giant garter snake in this area are evidently using a habitat feature such as riprap along the edge of a large body of moving water like the San Joaquin River that other giant garter snakes have not been observed using with any frequency elsewhere.

Large (400 - 700 acres) non-tidal wetland restoration efforts were conducted both on Sherman Island through DWR and on Twitchell Island through a partnership of DWR and Ducks Unlimited. These non-tidal inter-island wetlands provide high quality habitat that could support a giant garter snake population. Otherwise, it is largely unknown whether other reproducing source populations of giant garter snake occur within the various wetland habitats of the Central and Western Delta. Focused surveys in these areas are hindered either due to inaccessibility to privately owned lands or lack of resources.

The Corps consulted with the Service on their Sacramento River and Stockton Deepwater Ship Channel Dredging Project (Service File No. 08FBDT00-2016-F-0098). Part of the project involved the placement of dredge spoils onto existing designated Dredging Material Placement Sites (DMPS) and the construction of a new 35-acre DMPS on Twitchell Island. The DMPSs consisted of several acres of land ranging from 26 acres to 590 acres. Five of the eight DMPSs were near suitable wetland habitats for giant garter snake and were considered as potential upland habitat. Placement of dredge spoils on these sites was identified to affect giant garter snake by temporarily disturbing habitat and take of giant garter snake in the form of harassment. The Corps dredging project occurs annually, although the annual use of each DMPS varies. Efforts to create a 140-acre giant garter snake conservation bank (Shin Kee Conservation Bank) adjacent to White Slough Wildlife Area are under way in coordination with the Service and other agencies.

### **9.5.3 Effects of the Proposed Action**

Construction of the HORG is not expected to affect giant garter snake because there is no suitable habitat in the vicinity of those construction activities. Operations of the facilities are not expected to affect giant garter snake; however, if aquatic habitat in the Delta is affected by changing in-Delta land management as a result of water quality changes by the PA, reinitiation may be necessary.

#### *North Delta Diversions*

Construction and ground disturbing activities related to the PA are likely to affect giant garter snake. Construction activities at each intake include ground clearing and grading, construction of the intakes and associated facilities, and vehicular use including transport of construction equipment and materials. Giant garter snake may be killed or injured by vehicles and heavy construction equipment used as part of the PA. This effect would be most likely to occur during site clearing (up to several days at each location). Vehicle strikes are a common threat to giant garter snake and several occurrence records of giant garter snake in CNDDDB are from dead individuals found along roadsides which were struck by vehicles. Giant garter snakes commonly use roadside ditches for movement corridors or for foraging and are known to use roadsides for

basking sites. The recent documented observations of giant garter snakes using riprap along major river levee banks also show that giant garter snakes can use this habitat for basking and sheltering and possibly for foraging or brumation/aestivation. This makes giant garter snakes highly vulnerable to vehicle strikes as giant garter snakes bask on the road or cross back and forth over roads from the various suitable aquatic and upland habitats.

Associated equipment noise, vibration, and increased human activity may interfere with normal behaviors. These behaviors include feeding, sheltering, movement between refugia and foraging habitats, and other essential behaviors of giant garter snake. Project related activities that occur in areas that have suitable habitat but create intolerable levels of disturbance may force individuals from cover and potentially subject them to circumstances that otherwise would not occur and could result in an increased threat to their survival such as predation.

Natural food sources may also be reduced as a result of habitat disturbance and loss. Short-term temporal effects will occur when vegetative cover is removed within upland habitat during project implementation, which may also subject this species to an increased risk of predation. Since snakes use small mammal burrows, soil crevices, and/or rock crevices for shelter for brumation during the winter season and aestivation during extremely hot days during their active period, the PA will likely have some adverse effect by harassing snakes away from suitable habitat or by disrupting brumation/aestivation if snakes are occupying a burrow or rock outcropping. As ground squirrel burrows can be deep and long, maintenance equipment may come into direct contact with an aestivating snake and a snake could be killed from ground disturbing activities. Snakes in terrestrial habitat may also become entombed under soil, crushed or damaged by equipment or personnel, thereby resulting in harm or mortality to individuals. To minimize these effects, DWR proposes a series of conservation measures such as work windows, exclusionary fencing, biological monitoring and worker awareness training.

The NDD is estimated to remove 74 acres of modeled habitat. This includes 12 acres of aquatic habitat and 62 acres of upland habitat. Of the estimated 74 acres of modeled habitat to be removed, 47 acres (3 acres of aquatic and 44 acres of upland) will result from construction of permanent facilities such as intake structures and associated electrical buildings and facilities, and permanent access roads. The remaining 27 acres (9 acres of aquatic and 18 acres of upland) of loss will result from use of the work areas, which will last for approximately 5 years at each intake. The Service considers impacts occurring over multiple years to be a permanent effect to listed species. To compensate for the loss of this habitat and minimize effects from habitat loss to giant garter snake, DWR proposes to either restore or protect high quality habitat areas targeted for giant garter snake recovery at a 2:1 ratio or create suitable habitats at a 3:1 ratio that would still benefit giant garter snake in the Delta. This would require 148 acres at the 2:1 ratio and 222 acres at the 3:1 ratio.

### *Mitigation/Restoration*

DWR proposes to compensate for permanent habitat loss and long-term adverse construction effects by purchasing habitat at a 2:1 ratio if the habitat is within a Service agreed-to high-

priority conservation area, such as the eastern protection area between Caldoni Marsh and Stone Lakes. Alternatively, the compensation may be at a ratio of 3:1 for both aquatic and upland habitat if the habitat is not within a high-priority conservation area. Therefore, depending on the habitat quality, the total amount of habitat protected will either be 2,325 acres or 1,550 acres.

#### *Preconstruction Studies (Geotechnical Explorations)*

Effects associated with geotechnical exploration are similar to those described for the NDD above. DWR proposes to conduct 1,380 to 1,430 overland borings and will require approximately 24 months using six land-based drill rigs operating concurrently for 6 days per week. Due to the sheer number of geotechnical explorations and the large proposed action area in which they occur, it is anticipated that individual giant garter snake near the localized area of the individual borings may be subject to intolerable levels of disturbance and/or be subject to injury or mortality if they come in contact with the boring machinery or any associated support vehicles or equipment.

DWR proposes that geotechnical explorations will avoid giant garter snake aquatic habitat but may temporarily affect up to 98 acres of upland habitat. The operation of equipment during construction could result in injury or mortality of giant garter snakes associated with the 98 acres of upland habitat. The potential for this effect will be minimized by confining activities within upland habitat to the active season, confining movement of heavy equipment to existing access roads or to locations outside upland habitat, and requiring that all construction personnel receive worker awareness training. The only permanent loss of giant garter snake habitat resulting from geotechnical explorations will be boreholes, which will be grouted upon completion. These holes are very small (approximately 8 inches diameter) and this permanent loss will have negligible effects on the giant garter snake. Except for the minimal habitat loss associated with boreholes, this temporary effect will consist of driving overland to access the boring sites, and storing equipment for short time periods (a few hours to 12 days).

#### *Conveyance Tunnels*

The water conveyance facilities that overlap with giant garter snake habitat include a tunnel work area, the intermediate forebay and spillway, a road interchange, vent shafts, barge unloading facilities, temporary or permanent work areas and access roads.

Effects associated with the tunnel conveyance construction are similar to those described for the NDD above. These effects are anticipated to occur throughout the scheduled construction timeframe (2018-2030). Construction activities associated with the conveyance facilities will include short-term segment storage, fan line storage, crane use, dry houses, settling ponds, daily spoils piles, use of power supplies, air, and water treatment. There will also be slurry wall construction at some sites, and associated slurry ponds. Access routes and new permanent access roads will be constructed for each shaft site.

The mapped water conveyance facilities overlap with 220 acres of giant garter snake modeled habitat including 127 acres of upland habitat and 93 acres of aquatic habitat. The 220 acres of giant garter snake habitat to be removed because of conveyance facility construction consists of multiple small areas spread out across the action area. Because the population status of giant garter snake is undetermined, it is unknown the effects to loss of this habitat will have on giant garter snake or whether it will create habitat isolation or fragmentation. To compensate for the loss of this habitat and minimize effects from habitat loss to giant garter snakes, DWR proposes to either restore or protect high quality habitat areas targeted for giant garter snake recovery at 2:1 ratio or create suitable habitats at a 3:1 ratio that would still benefit giant garter snake in the Delta. This would require 440 acres at the 2:1 ratio and 660 acres at the 3:1 ratio.

#### *Clifton Court Forebay Modification*

Effects associated with the tunnel conveyance construction are similar to those described for the NDD above. Construction activities at CCF include vegetation clearing, pile driving, excavation, dredging, and cofferdam and embankment construction. Construction at CCF will be phased by location and the duration of construction will be approximately 6 years.

An estimated 238 acres of giant garter snake modeled habitat overlaps with the mapped Clifton Court Forebay modifications where land will be cleared for permanent facilities and temporary work areas. This includes the additional acreages proposed as part of the CCWD supplemental agreement. The 238 acres of modeled habitat includes 17 acres of aquatic habitat and 221 acres of upland habitat. DWR proposes to either restore or protect high quality habitat areas targeted for giant garter snake recovery at 2:1 ratio or create suitable habitats at a 3:1 ratio that would still benefit giant garter snake in the Delta. This would require 479 acres at the 2:1 ratio and 711 acres at the 3:1 ratio.

#### *Power Supply and Grid Connections*

Effects associated with the tunnel conveyance construction are similar to those described for the NDD above. Power supply and grid connections include the construction of temporary substations, site preparation for new tower or pole construction, and tower or pole construction with the use of cranes and/or helicopters. Effects are anticipated to only occur for no more than 1 year at each location. Construction of both temporary and permanent transmission line and the associated site preparation is anticipated to temporarily affect 67 acres of giant garter snake upland habitat. Permanent habitat loss will result from pole and tower placement, and will affect less than 1 acre of habitat. DWR proposes to offset the effects of the 67 acres of temporary habitat disturbance by returning these areas to pre-project conditions. The permanent loss of up to 1 acre of upland habitat will be compensated at a 2:1 or 3:1 ratio.

#### *Reusable Tunnel Material Placement Sites*

The project proposes to mobilize over 30 million cubic yards of earthen spoils from the tunnels construction and place it over 2,558 acres of land. Each RTM storage area is anticipated to take 5-8 years to construct and fill. This will require the use of heavy earthmoving equipment such as

dozers, graders, tillers and other machinery to move and rotate the soils. There is a strong potential to create a continuous level of intolerable disturbance from the movement of vehicle and heavy equipment used to carry spoils to the various sites and deposit the material for storage. Giant garter snakes are not typically found around areas of high disturbance and any giant garter snake occupying or in the vicinity of the proposed RTM placement sites will likely evacuate the area. There would then be a low probability of a giant garter snake returning and reoccupying the site during the continued disturbance essentially making the entire site unusable as habitat for the entirety of the construction timeframe. The RTM placement sites have the potential to become suitable upland habitat after construction and spoil placement has ended if there are suitable emergent aquatic habitats nearby. However, this is speculative and highly dependent on the natural recruitment of vegetative cover and fossorial small mammals.

The project has proposed eight RTM placement sites. Four of the sites occur within the vicinity of the Intermediate Forebay site between the Cosumnes River and the Stone Lakes Preserve. Removal of suitable habitat within these locations may contribute to fragmentation by diminishing the existing string of small habitat blocks between the larger Mokelumne and the Stone Lakes habitat blocks. The Bouldin Island RTM placement site is the largest of the eastern delta sites (excluding the CCF RTM site) and represents a large portion of ground disturbance and block of habitat removal/modification that may serve as a potential barrier to dispersal, genetic intermixing, and contribute to fragmentation by diminishing the existing string of small habitat blocks between the giant garter snake population at the Caldoni Marsh/White Slough Wildlife Area and the recent cluster of giant garter snake occurrences found in and around the western Delta (Sherman Island, Jersey Island, Bradford Island, Twitchell Island, and Webb Tract). This barrier would likely only occur during the construction phase of the RTM placement site until suitable habitat in the area can be created/restored or the formation of suitable emergent vegetation aquatic habitat occurs. This is dependent on future colonization of upland vegetative cover and the fossorial small mammals that would eventually provide the burrows that giant garter snake could use for brumation/aestivation.

RTM placement site construction is estimated to remove 242 acres of giant garter snake modeled habitat. The 242 acres of modeled habitat includes 83 acres of aquatic habitat and 159 acres of upland habitat. DWR proposes to either restore or protect high quality habitat areas targeted for giant garter snake recovery at 2:1 ratio or create suitable habitats at a 3:1 ratio that would still benefit giant garter snake in the Delta. This would require 484 acres at the 2:1 ratio and 726 acres at the 3:1 ratio.

### *Common Construction-related Activities*

These are activities that are associated with the previously described actions. They are general activities and may be used in part or in whole for all sites as necessary. These activities include clearing, site work, ground improvement, borrow/fill, and fill to flood height for necessary levees and embankments.

All of these activities typically require the use of heavy earth moving equipment and vehicles